

Appl. No. 10/706,483
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Response to Office action dated 09/03/2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (Previously presented): A germicidal lamp for harsh environments adapted to be mounted on a wall, the wall having an insertion opening, the germicidal lamp comprising:

a low pressure germicidal tube which when energized emits UVC without substantial ozone and can withstand skin-effect cooling, the tube including an envelope and a stem, and

a fixture comprising a cover, a base and a tube holder, wherein

the base has an upper surface and a lower surface,

the lower surface of the base seals against the wall to thereby prevent splashing water, hose-directed water, ice formations, wind, dirt, rain and environmental corrosion to pass there through,

the cover is at least partially detachable from the base so that the cover can be moved from a first position wherein the cover covers the upper surface to a second position wherein the cover is at least partially separated from the base to at least partially expose the upper surface of the base,

the cover and the upper surface of the base define an interior space within the fixture,

the cover seals tightly to the base to thereby prevent splashing water, hose-directed water, ice formations, wind, rain and environmental corrosion from entering the interior space of the fixture,

the base includes an opening through which the envelope of the tube is passed for installation of the tube in the fixture and removal of the tube from the fixture,

installation of the tube causes a flange on the tube stem to sealingly engage the base which seals the opening in the base of the fixture from air flow into the fixture,

the tube-holder, including an engaging surface adapted to engage and secure the stem of the tube,

after the envelope has been inserted through the opening in the base of the fixture,

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the cover and the base include exterior surfaces which are resistant to splashing water, hose-directed water, ice formations, wind, rain and environmental corrosion.

Claim 2 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 wherein the tube comprises an elongate hollow cylinder.

Claim 3 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 wherein the tube is adapted such that UVC output from the tube peaks when an air flow of between 200 cfm and 600 cfm at between 30.degree. F. and 65.degree. F. is passed across the tube.

Claim 4 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 3 wherein the tube is adapted such that UVC output from the tube peaks when an air flow of 400 cfm at 55.degree. F. is passed across the tube.

Claim 5 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 wherein the tube emits UVC of at least $10 \cdot \mu\text{W}/\text{cm} \cdot \text{sup.2}$ per inch arc length at one meter when an airflow of between 100 and 800 cfm is passed across the tube.

Claim 6 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 wherein the tube emits UVC of at least $10 \cdot \mu\text{W}/\text{cm} \cdot \text{sup.2}$ per inch arc length at one meter when an air flow of between 0.degree. F. and 70.degree. F. is passed across the tube.

Claim 7 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 having a weight of less than two lbs.

Claim 8 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 wherein the cover and the base of the fixture are separable.

Claim 9 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 wherein the cover and the base of the fixture have a clamshell design.

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Claim 10 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 wherein the base of the fixture includes the tube-holder.

Claim 11 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 10 wherein the tube-holder comprises a spring clamp attached to the upper surface of the base of the fixture around the opening in the base, the spring clamp comprising a spring, a mount and two stops, the spring comprising wire in a substantially flat U shape, the stem of the spring's U being fixed by the mount to the upper surface of the base adjacent the opening such that the arms of the U are disposed on opposite sides of the opening, the mount allowing the spring to rotate such that the spring can be pivoted about the mount between a position substantially parallel to the upper surface to a position substantially perpendicular to the upper surface, the stops holding the spring in compression and parallel to the upper surface, wherein the spring clamp wraps at least partially around the stem of the tube and presses the stem against the upper surface of the base of the fixture and thereby holds the tube in place and the tube in the fixture.

Claim 12 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 wherein the tube-holder is attached to the cover of the fixture, wherein the tube-holder is positioned in the cover such that, when the cover is closed onto the base of the fixture, the tube-holder also engages the stem of the tube and holds the tube firmly in place.

Claim 13 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 wherein the tube-holder includes an electrical connector which engages at least one electrode in the stem of the tube when the tube-holder engages the stem.

Claim 14 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1, wherein installation of the tube causes the a flange on tube stem to sealingly engage the base, forming a seal, the seal is adapted to be seated around the opening in the base to thereby prevent splashing water, hose-directed water, ice formations, wind, dirt, rain and environmental corrosion to pass there through.

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Claim 15 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted to a wall of claim 1 wherein the lower surface of the base seals against a wall, creating a seal between the fixture and the wall that can withstand air pressure of at least 15 inches of water gage.

Claim 16 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1, the cover and the base of the fixture defining an interior space, the fixture further comprising a power supply adapted to convert an input power source into a form appropriate for the tube.

Claim 17 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 1 further including an electrical connector disposed within the fixture adapted to electrically engage the stem of the tube, the germicidal lamp further including plural electrical leads attached to the electrical connector and extending outside of the fixture, the leads including piggyback connectors adapted to be connected to an air conditioner's power or fan controller, whereby other connectors on the controller can be removed from the controller and attached to the piggyback connector, and the piggyback can then be attached to the controller in place of the other connector.

Claim 18 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted to a wall of claim 1, wherein installation of the tube causes a flange of the stem to sealingly engage the base and form a seal between the tube and the fixture that can withstand air pressure of at least 30 inches of water gage.

Claim 19 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted to a wall of claim 1, wherein the cover seals tightly to the base to form a seal between the cover and the base that can withstand air pressure of at least 20 inches of water gage.

Claim 20 (Previously presented): An air handling system comprising the germicidal lamp of claim 1.

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Claim 21 (Previously presented): An HVAC system comprising the germicidal lamp of claim 1.

Claim 22 (Previously presented): A germicidal lamp for harsh environments comprising:

a single-walled tube having a stemmed end with a flange, and a free end and comprising an envelope disposed between the ends having a first cross-sectional shape,

a rigid stem secured to the envelope at the stemmed end, the stem including at least one electrode; and

a fixture comprising:

a base having an upper surface and a lower surface, the base including an opening through which the envelope of the tube is passed for installation of the tube in the fixture and removal of the tube from the fixture, but through which the stem will not fully pass, the flange on the stemmed end of the tube sealingly engaging the base when the tube is installed, the lower surface of the base sealing against a wall to thereby prevent splashing water, hose-directed water, ice formations, wind, rain and environmental corrosion to pass there through, the base including an exterior surface which is resistant to splashing water, hose-directed water, ice formations, wind, rain and environmental corrosion;

a socket disposed inside of the fixture and electrically coupled to at least one electrode;

a cover which is at least partially detachable from the base so that the cover can be moved from a first position wherein the cover covers the upper surface and the cover can be partially moved away from the base to at least partially expose the upper surface of the base, the cover sealing tightly to the base to thereby prevent splashing water, hose-directed water, ice formations, wind, rain and environmental corrosion from entering the interior space of the fixture, the cover including an exterior surfaces which are resistant to splashing water, hose-directed water, ice formations, wind, rain and environmental corrosion;

a tube holder including an engaging surface adapted to engage and secure the stem of the tube.

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Claim 23 (Previously presented): The germicidal lamp for harsh environments of claim 22, the tube-holder comprising a spring clamp coupled to the primary wall around the opening, the spring clamp comprising a spring, a mount and two stops, the spring comprising wire in a substantially flat U shape, the stem of the spring's U being fixed by the mount to the first wall adjacent the through-hole such that the arms of the U are disposed on opposite sides of the through-hole, the mount allowing the spring to rotate such that the spring can be pivoted about the mount from a position substantially parallel to the first wall to a position substantially perpendicular to the first wall, the stops holding the spring in compression and parallel to the first wall;

wherein the spring clamp wraps at least partially around the stem and presses the stem into the primary wall and thereby holds the tube in place.

Claim 24 (Previously presented): The germicidal lamp for harsh environments of claim 22 wherein the tube comprises a low pressure germicidal tube which, when energized, emits UVC without substantial ozone and can withstand skin effect cooling in an air flow of between 200 cfm and 600 cfm at between 30.degree. F. and 65.degree. F.

Claim 25 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 22 wherein the tube emits UVC of at least $10\text{-}\mu\text{W/cm}\cdot\text{sup.2}$ per inch arc length at one meter when an airflow of between 100 and 800 cfm is passed across the tube.

Claim 26 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 22 wherein the tube emits UVC of at least $10\text{-}\mu\text{W/cm}\cdot\text{sup.2}$ per inch arc length at one meter when an air flow of between 0.degree. F. and 70.degree. F. is passed across the tube.

Claim 27 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted on a wall of claim 22 having a weight of less than two pounds.

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Claim 28 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted to a wall of claim 22 wherein the lower surface of the base sealing against a wall forms a seal between the fixture and the wall that can withstand air of at least 15 inches of water gage.

Claim 29 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted to a wall of claim 22, wherein the flange on the stemmed end of the tube sealing engaging the base when the tube is installed forms a seal between the tube and the fixture that can withstand air pressure of at least 30 inches of water gage.

Claim 30 (Previously presented): The germicidal lamp for harsh environments adapted to be mounted to a wall of claim 22, wherein the cover sealingly tight to the base forms a seal between the cover and the base that can withstand air pressure of at least 20 inches of water gage.

Claim 31 (Previously presented): An air handling system comprising the germicidal lamp of claim 22.

Claim 32 (Previously presented): An HVAC system comprising the germicidal lamp of claim 22.

Claim 33 (Currently amended): A germicidal system resistant to environmental exposure comprising:

- a germicidal tube comprising an envelope, a stem, and a gas enclosed by the envelope and the stem

- a power supply adapted to receive power from an external source and provide power to the germicidal tube

- an electrical interface electrically connecting an electrode of the stem and the power supply via plural wires

- a fixture supporting the power supply and the germicidal tube

- a cover adapted to ~~ruggedize~~ protect the electrical interface ~~from an environmental condition selected from the group comprising falling dirt, rain, sleet, snow, windblown dust, formation of ice, splashing water, hose directed water, and environmental corrosion, the cover comprising~~

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~~an exterior surface resistant to at least one of falling dirt, rain, sleet, snow, windblown dust, formation of ice, splashing water, hose directed water, and environmental corrosion~~
a material resistant to at least one of selected from the group comprising of external ~~impacts~~ impact, UV exposure, environmental exposure, heat, and moisture.

Claim 34 (Previously presented): The germicidal system resistant to environmental exposure of claim 33, wherein the cover is further adapted to couple to the fixture and at least partially enclose the electrical interface.

Claim 35 (Previously presented): The germicidal system resistant to environmental exposure of claim 34, wherein the cover is further adapted to seal to the fixture.

Claim 36 (Previously presented): The germicidal system resistant to environmental exposure of claim 35, wherein the cover is completely enclosing the electrical interface.

Claim 37 (Previously presented): The germicidal system resistant to environmental exposure of claim 36, wherein the material is thick and rigid.

Claim 38-41 (Canceled)

Claim 42 (Currently amended): ~~The A~~ germicidal system for harsh environments of claim 38, the germicidal system comprising:

a germicidal tube comprising an envelope, a stem, and a gas enclosed by the envelope and the stem

a power supply adapted to receive power from an external source and provide power to the germicidal tube

a fixture comprising

a base adapted for mounting on an external surface of a wall, including an opening through which the envelope of the tube is passed for installation of the tube in the fixture and

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removal of the tube from the fixture, whereby the installation of the tube in the fixture couples the tube to the fixture

one or more fixture walls coupled to the base wherein the stem, the base and the fixture walls define an interior space of the fixture

a tube holder, attached to one of the fixture walls, for holding the germicidal tube, at least partially support the germicidal tube

wherein the fixture is resistant to an environmental condition including at least one of selected from the group comprising falling dirt, rain, sleet, snow, windblown dust, formation of ice, splashing water, hose directed water, environmental corrosion to protect the interior space of the fixture from the environmental condition

wherein the tube holder includes an electrical connector which engages at least one electrode in the stem of the tube when the tube holder engages the stem.

Claim 43 (Currently amended): The A germicidal system for harsh environments of claim 38, the germicidal system comprising:

a germicidal tube comprising an envelope, a stem, and a gas enclosed by the envelope and the stem

a power supply adapted to receive power from an external source and provide power to the germicidal tube

a fixture comprising

a base adapted for mounting on an external surface of a wall, including an opening through which the envelope of the tube is passed for installation of the tube in the fixture and removal of the tube from the fixture, whereby the installation of the tube in the fixture couples the tube to the fixture

one or more fixture walls coupled to the base wherein the stem, the base and the fixture walls define an interior space of the fixture

a tube holder, attached to one of the fixture walls, for holding the germicidal tube, at least partially support the germicidal tube.

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wherein the germicidal tube when energized emits UVC without substantial ozone and can withstand skin-effect cooling in an air flow of between 200 cfm and 600 cfm at between 30 degrees Fahrenheit and 65 degrees Fahrenheit.

Claim 44 (Canceled)

Claim 45 (Currently amended): ~~The A~~ germicidal system for harsh environments ~~of claim 38, the~~
germicidal system comprising:

a germicidal tube comprising an envelope, a stem, and a gas enclosed by the envelope and the stem

a power supply adapted to receive power from an external source and provide power to the germicidal tube

a fixture comprising

a base adapted for mounting on an external surface of a wall, including an opening through which the envelope of the tube is passed for installation of the tube in the fixture and removal of the tube from the fixture, whereby the installation of the tube in the fixture couples the tube to the fixture

one or more fixture walls coupled to the base wherein the stem, the base and the fixture walls define an interior space of the fixture

a tube holder, attached to one of the fixture walls, for holding the germicidal tube, at least partially support the germicidal tube

wherein

at least one of the fixture walls and the base of the fixture have a clamshell design
the tube holder includes an electrical connector which engages at least one electrode in the stem of the tube when the tube-holder engages the stem

the germicidal tube which, when energized, emits UVC without substantial ozone and can withstand skin effect cooling in an air flow of between 200 cfm and 600 cfm at between 30 degrees Fahrenheit and 65 degrees Fahrenheit.

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Claim 46 (Currently amended): A germicidal system resistant to environmental exposure comprising:

a germicidal tube comprising an envelope, a stem, and a gas enclosed by the envelope and the stem

means for receiving power from an external source and providing power to the germicidal tube

means for electrically connecting an electrode of the stem and the power receiving and providing means

means for supporting the power receiving and providing means and the germicidal tube

means for ~~ruggedizing~~ protecting the electrically connecting means from an environmental condition selected from the group comprising falling dirt, rain, sleet, snow, windblown dust, formation of ice, splashing water, hose directed water, and environmental corrosion, the means for protecting comprising

~~an exterior surface resistant to at least one of falling dirt, rain, sleet, snow, windblown dust, formation of ice, splashing water, hose directed water, and environmental corrosion condition~~

a material resistant to at least one of selected from the group comprising an external impacts, an UV exposure, an environmental exposure, a heat, and a moisture.

Claim 47 (Currently amended): The germicidal system resistant to environmental exposure of claim 46, wherein the ~~ruggedizing~~ protecting means includes means for coupling to the supporting means and means for at least partially enclosing the electrically connecting means.

Claim 48 (Currently amended): The germicidal system resistant to environmental exposure of claim 47, wherein the ~~ruggedizing~~ protecting means includes means for sealing to the supporting means.

Claim 49 (Currently amended): The germicidal system resistant to environmental exposure of claim 48, wherein the ~~ruggedizing~~ protecting means is completely enclosing the electrically connecting means.

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Claim 50 (Previously presented): The germicidal system resistant to environmental exposure of claim 49, wherein the material is thick and rigid.

Claim 51-54 (Canceled)

Claim 55 (Currently amended): ~~The~~ A germicidal system for harsh environments ~~of claim 51, the~~
germicidal system comprising:

a germicidal tube comprising an envelope, a stem, and a gas enclosed by the envelope and the
stem

means for receiving power from an external source and providing power to the germicidal
tube

a fixture comprising

means for mounting on an external surface of a wall, including an opening through
which the envelope of the tube is passed for installation of the tube in the fixture and removal
of the tube from the fixture, whereby the installation of the tube in the fixture couples the
tube to the fixture

means for coupling to the mounting means wherein the stem, the mounting means
and the coupling means define an interior space of the fixture

means for at least partially supporting the germicidal tube wherein the supporting means is
attached to the coupling means

wherein the fixture is resistant to an environmental condition selected from the group
comprising falling dirt, rain, sleet, snow, windblown dust, formation of ice, splashing water, hose
directed water, environmental corrosion to protect the interior space of the fixture from the
environmental condition

wherein the supporting means includes means for electrically engaging at least one electrode
in the stem of the tube when the supporting means engages the stem.

Claim 56 (Currently amended): ~~The~~ A germicidal system for harsh environments ~~of claim 51, the~~
germicidal system comprising:

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a germicidal tube comprising an envelope, a stem, and a gas enclosed by the envelope and the stem

means for receiving power from an external source and providing power to the germicidal tube

a fixture comprising

means for mounting on an external surface of a wall, including an opening through which the envelope of the tube is passed for installation of the tube in the fixture and removal of the tube from the fixture, whereby the installation of the tube in the fixture couples the tube to the fixture

means for coupling to the mounting means wherein the stem, the mounting means and the coupling means define an interior space of the fixture

means for at least partially supporting the germicidal tube wherein the supporting means is attached to the coupling means

wherein the fixture is resistant to an environmental condition selected from the group comprising falling dirt, rain, sleet, snow, windblown dust, formation of ice, splashing water, hose directed water, environmental corrosion to protect the interior space of the fixture from the environmental condition

wherein the germicidal tube when energized emits UVC without substantial ozone and can withstand skin-effect cooling in an air flow of between 200 cfm and 600 cfm at between 30 degrees Fahrenheit and 65 degrees Fahrenheit.

Claim 57 (Canceled)

Claim 58 (Currently amended): ~~The~~ A germicidal system for harsh environments of claim 51, the germicidal system comprising:

a germicidal tube comprising an envelope, a stem, and a gas enclosed by the envelope and the stem

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means for receiving power from an external source and providing power to the germicidal tube

a fixture comprising

means for mounting on an external surface of a wall, including an opening through which the envelope of the tube is passed for installation of the tube in the fixture and removal of the tube from the fixture, whereby the installation of the tube in the fixture couples the tube to the fixture

means for coupling to the mounting means wherein the stem, the mounting means and the coupling means define an interior space of the fixture

means for at least partially supporting the germicidal tube wherein the supporting means is attached to the coupling means

wherein the fixture is resistant to an environmental condition selected from the group comprising falling dirt, rain, sleet, snow, windblown dust, formation of ice, splashing water, hose directed water, environmental corrosion to protect the interior space of the fixture from the environmental condition

wherein

the coupling means and the mounting means of the fixture have a clamshell design
the supporting means includes an electrically engaging means which engages at least one electrode in the stem of the tube when the supporting means engages the stem

the germicidal tube which, when energized, emits UVC without substantial ozone and can withstand skin effect cooling in an air flow of between 200 cfm and 600 cfm at between 30 degrees Fahrenheit and 65 degrees Fahrenheit.

Claims 59-60 (Canceled)

Claim 61 (Currently amended): The A germicidal lamp for harsh environments of claim 59, comprising:

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means for emitting UVC without substantial ozone and for withstanding skin-effect cooling,
the emitting means including an envelope and a stem

a fixture comprising

means for sealing against a wall to thereby prevent splashing water, hose-directed
water, ice formations, wind, dirt, rain and environmental corrosion to pass there through

means for opening the fixture

means for sealing the fixture tightly to thereby prevent splashing water, hose-directed
water, ice formations, wind, rain and environmental corrosion from entering the interior space of the
fixture

means for allowing the emitting means to be passed through the fixture for
installation and removal

means for sealing the fixture from air flowing into the fixture

means for engaging and securing the emitting means

wherein the emitting means includes means for causing UVC output to peak when an air flow
of between 200 cfm and 600 cfm at between 30 °F and 65 °F is passed across the emitting means.

Claim 62 (Previously presented): The germicidal lamp for harsh environments of claim 61, wherein
the emitting means includes means for causing UVC output to peak when an air flow of 400 cfm at
55 F is passed across the emitting means.

Claim 63 (Currently amended): ~~The A~~ germicidal lamp for harsh environments ~~of claim 59,~~
comprising:

means for emitting UVC without substantial ozone and for withstanding skin-effect cooling,
the emitting means including an envelope and a stem

a fixture comprising

means for sealing against a wall to thereby prevent splashing water, hose-directed
water, ice formations, wind, dirt, rain and environmental corrosion to pass there through

means for opening the fixture

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means for sealing the fixture tightly to thereby prevent splashing water, hose-directed water, ice formations, wind, rain and environmental corrosion from entering the interior space of the fixture

means for allowing the emitting means to be passed through the fixture for installation and removal

means for sealing the fixture from air flowing into the fixture

means for engaging and securing the emitting means

wherein the emitting means includes means for emitting UVC of at least $10 \mu\text{W}/\text{cm}^2$ per inch arc length at one meter when an airflow of between 100 and 800 cfm is passed across the emitting means.

Claim 64 (Currently amended): ~~The A~~ germicidal lamp for harsh environments ~~of claim 59,~~
comprising:

means for emitting UVC without substantial ozone and for withstanding skin-effect cooling,
the emitting means including an envelope and a stem

a fixture comprising

means for sealing against a wall to thereby prevent splashing water, hose-directed water, ice formations, wind, dirt, rain and environmental corrosion to pass there through

means for opening the fixture

means for sealing the fixture tightly to thereby prevent splashing water, hose-directed water, ice formations, wind, rain and environmental corrosion from entering the interior space of the fixture

means for allowing the emitting means to be passed through the fixture for installation and removal

means for sealing the fixture from air flowing into the fixture

means for engaging and securing the emitting means

wherein the emitting means includes means for emitting UVC of at least $10 \mu\text{W}/\text{cm}^2$ per inch arc length at one meter when an air flow of between 0 °F and 70 °F is passed across the tube.

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Claim 65 (Currently amended): The germicidal lamp for harsh environments of claim 59 61, having a weight of less than two lbs.

Claim 66 (Currently amended): The germicidal lamp for harsh environments of claim 59 61, wherein the fixture includes means for separating.

Claim 67 (Currently amended): The germicidal lamp for harsh environments of claim 59 61, wherein the fixture has a clamshell design.

Claim 68 (Currently amended): The germicidal lamp for harsh environments adapted to be mounted to a wall of claim 59 61, including means for sealing the fixture against the wall, creating a seal between the fixture and the wall that can withstand air pressure of at least 15 inches of water gage.

Claim 69 (Currently amended): The germicidal lamp for harsh environments adapted to be mounted to a wall of claim 59 61, including means for sealing the fixture to withstand air pressure of at least 30 inches of water gage.

Claim 70 (Previously presented): An air handling system comprising the germicidal lamp of claim 59 33.

Claim 71 (Previously presented): An HVAC system comprising the germicidal lamp of claim 59 33.